Best Practicable Environmental Option Assessment

Port of Aberdeen Maintenance Dredging

October 2025

HARRIS HOLDEN

Contents

Appendices

Document history

Version	Date	Notes
POA-BPEO2025-R1	2 October 2025	Draft issued for review
POA-BPEO2025-R2	09 October 2025	Final issue

1. Introduction

The Port of Aberdeen is Scotland's busiest port, handling 43% of the nation's commercial vessel traffic. It generates £1.5bn gross value added annually and supports 12,000 jobs. It is the mainland port for the lifeline service to the Northern Isles and as well as general cargo and passengers. Aberdeen is the largest UK support harbour for the North Sea Energy Industry.

As a statutory harbour authority, the Port of Aberdeen is required to carry out maintenance dredging of navigation channels and berths to maintain safe navigable depths and support customers' business needs. The Aberdeen Harbour Revision Order 2016 gives the Port of Aberdeen powers to dredge within its statutory harbour limits.

This report presents the Best Practicable Environmental Option (BPEO) assessment for maintenance dredged material from Aberdeen North and South Harbours, to support an application to Marine Directorate – Licensing Operations Team (MD-LOT) to deposit dredged material at sea.

BPEO assessment is a method for identifying the option that provides the *most environmental benefit* or *least environmental damage*. It assesses the performance of different options using a range of criteria such as environmental impact, technical feasibility and cost.

2. Description of dredging activity and dredged material

2.1. Dredging activity

Aberdeen North Harbour has a record of dredging going back around 200 years, although it is likely that dredging has been ongoing in some form throughout the Port of Aberdeen's 900+ year history. South Harbour became operational in 2022.

In recent years, maintenance dredging has been carried out mainly with a trailer suction hopper dredger (TSHD), working in conjunction with a bed levelling tug. The latter is used to smooth out any local 'high spots' that either develop naturally or are left by the TSHD. The dredged material is taken by the TSHD to the designated offshore deposit site Aberdeen CR110, approximately 2.5 nautical miles to the southeast of the harbour entrance.

Maintenance dredging is typically carried out once a year within the areas shown in Figure 1 and Figure 2, although sometimes an additional winter dredging campaign is required due to accretion of material in the navigation channel caused by winter storms.

Maintenance dredging is typically carried out in spring each year, after any winter storms, depending on the availability of dredging plant. The duration of the campaign will vary from two to four weeks depending on the dredge volumes and weather/operational delays.

The volume of material removed annually from the harbour and channel varies between 100,000 to 200,000 m^3 in-situ sand and silt. The maintained dredge depths vary.

This BPEO considers the material that is dredged using a TSHD or backhoe. For plough dredging, there is no 'disposal' so a BPEO is not required.

2.2. Material to be dredged

In August 2025, 17 surface sediment samples were collected from the areas to be dredged, as agreed with MD-LOT. Full sampling results are provided in Appendix A.

2.2.1. Physical characteristics

The sampled material is predominantly mixed silt (average 57%) and sand (average 42%), with a very small gravel fraction (average 1%).

2.2.2. Chemical characteristics

The chemical analysis of sediment samples has been compared to the MD-LOT Revised Action Levels, which are used to determine the contaminant loading of the material and its suitability for deposition at sea.

For heavy metals, levels of copper were elevated above Action Level 1 in six of the samples analysed (five in the North Harbour, one in the South Harbour). In all cases the levels were well below Action Level 2.

Levels of all other heavy metals, polychlorinated biphenyls, tributyl tin and dibutyl tin were below Action Level 1 in all samples.

Levels of various polycyclic aromatic hydrocarbons (PAHs) and total hydrocarbons were elevated above Action Level 1 in 16 of the samples. As shown in the ‘PR Details’ sheet in Appendix A, the average wet weight concentration from all samples is below Action Level 1 for all PAHs and total hydrocarbons.

The levels observed in the 2025 samples are comparable to samples analysed in 2020 and 2022, which were deemed acceptable for deposition at sea by MD-LOT.

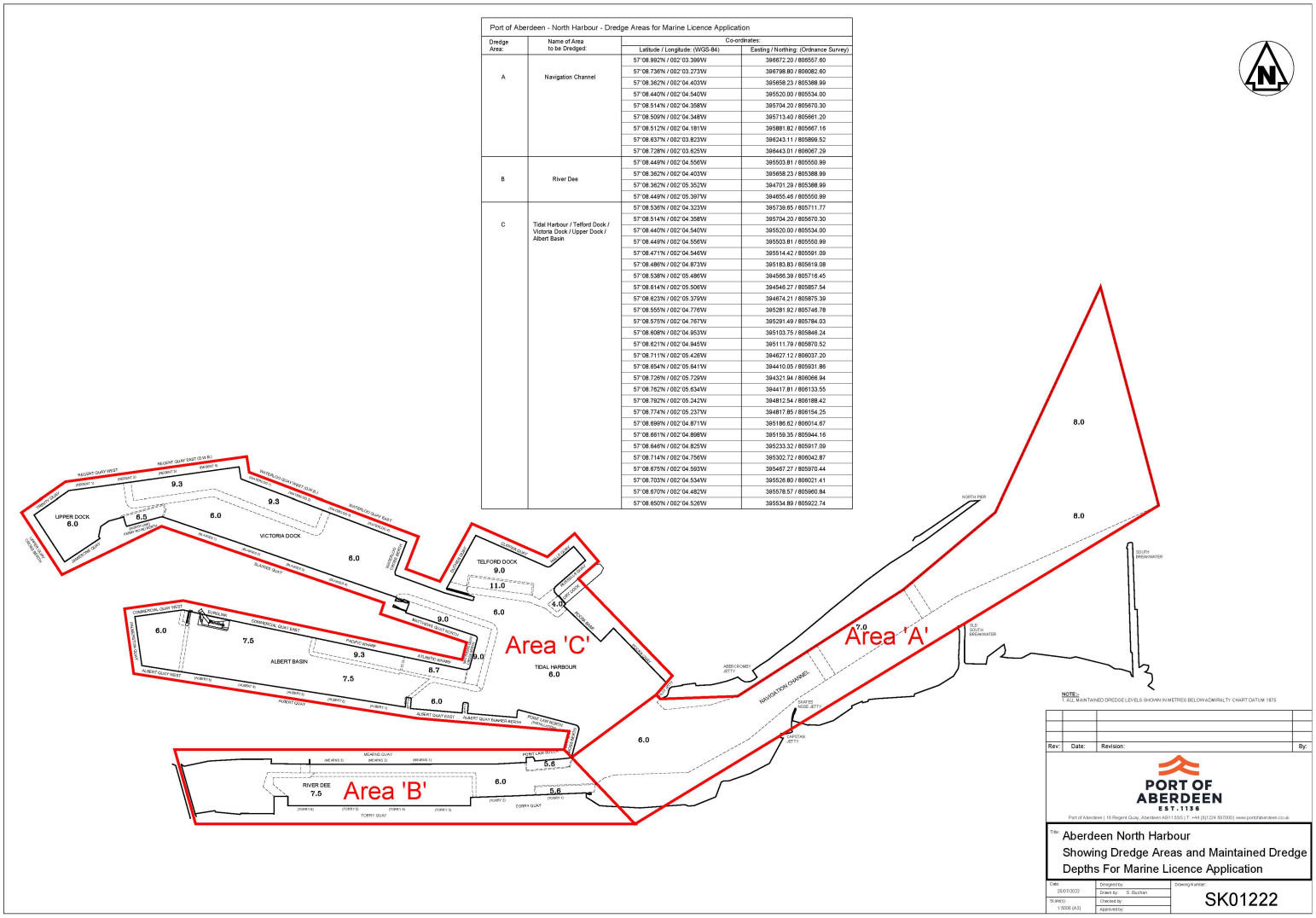

Figure 1 Areas to be dredged: North Harbour

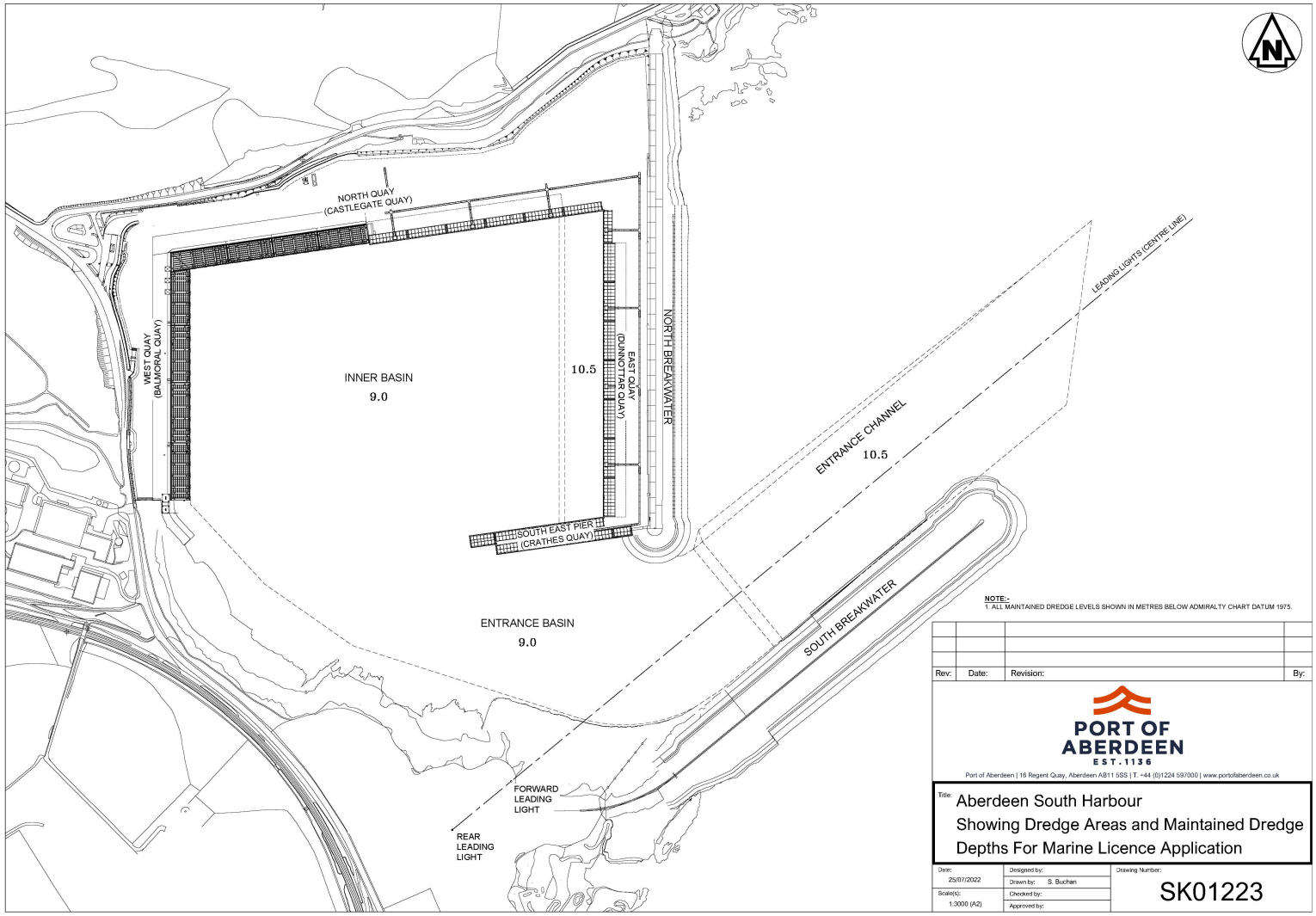

Figure 2 Areas to be dredged: South Harbour

3. Scoping of potential options

This section describes potential options for the dredged material. Where an option is not considered feasible, the reason is given and it is not taken forward to the assessment stage. Options that are considered practicable are considered in detail in Section 4.

3.1. Option 1: Landfill

The most common use of dredged material within landfill sites is as capping or restoration material. Material would need to be brought ashore within the port estate and dewatered before being transported to trucks and taken by road to a landfill site. Suitable land for drying lagoons is not available within the port estate.

There are no suitable landfill sites in the immediate vicinity of the Port of Aberdeen that could cope with a relatively large quantity of material on an annual basis. The closest operational landfill site to Aberdeen Harbour that is authorised by the Scottish Environment Protection Agency (SEPA) is Loch Hills Quarry in Dyce, approximately 15 km to the north by road from Aberdeen South Harbour (SEPA, 2025).

Existing landfill sites must cope with large volumes of domestic and industrial requirements, and marine dredgings on the present scale would place an intolerable burden on such sites. Dredged material is relatively inert by landfill standards, so disposal at a landfill site is not usually necessary or recommended unless it is significantly contaminated, which it is not in this case (see Section 2.2.2).

Transportation of material from the harbour to a landfill site would generate significant vehicle movements on local roads, contributing to traffic congestion and air and noise pollution.

This option has been discounted.

3.2. Option 2: Deposition at sea

The dredged material is considered chemically suitable for deposition at sea (see Section 2.2.2).

Sea deposit sites are designated by MD-LOT. The closest licensed sea deposit site to the Port of Aberdeen is CR110 (Aberdeen), approximately 20 minutes' sailing time from the port. Dredged material from Aberdeen North Harbour has been deposited at this site for at least 80 years.

The nature of the dredged material and the proximity of a suitable licensed site makes deposition at sea a viable option, and it is explored in more detail in Section 4.

3.3. Option 3: Agriculture use

The north-east of Scotland is a rural farming area with an abundance of good arable land and there is no known requirement for a supply of imported material. The dredged material would have to be de-watered and desalinated to make it suitable for soil conditioning or spreading, and no land is available within the port estate to locate a drying lagoon.

This option has been discounted.

3.4. Option 4: Use in land reclamation

Dredged material can be suitable for land reclamation. The material grade and quality are critical: material suitable for reclamation is generally medium to coarse sands and gravel fractions, typically in large volumes. The material to be dredged is predominantly mixed silt and sand (see Section 2.2.1) so is unlikely to be suitable for land reclamation.

Furthermore, no land reclamation projects have been identified within Aberdeen or the locality which require dredged material for land reclamation purposes.

This option is discounted for the current marine licence application; however, it will be kept under review in future revisions of the BPEO should there be a local need that aligns with the timescale required for maintenance dredging.

3.5. Option 5: Use as construction material

The saline content of the dredged material makes it unsuitable as a construction material. The grading and washing required coupled with the drying and storage challenges previously identified makes this option uneconomical and unpractical.

This option has been discounted.

3.6. Option 6: Beach recharge

The use of dredged material for beach recharge is a sustainable option: it generates a purpose for the material that benefits a local amenity. Material can be deposited direct from the dredging vessel via a pipeline or by ‘rainbowing’ onto the beach, where it is reprofiled using land-based plant.

This option is considered feasible and is explored in more detail in Section 4.

3.1. Summary of options scoping

The scoping of potential options concludes that options 1 (landfill), 3 (agricultural use), 4 (land reclamation) and 5 (construction material) are not viable for the reasons described above. The following options will be taken forward to assessment:

- Deposition at sea
- Beach recharge

4. Assessment of options

In this section, deposition at sea and beach recharge are assessed further for strategic, environmental and financial considerations.

4.1. Assessment methodology

MD-LOT's general licensing guidance (MD-LOT, 2015) states the following in relation to BPEO assessment: *'consideration must be given to the availability of practical alternatives when considering any applications involving disposal of material at sea. In order for MS-LOT [sic] to assess the available alternative options, all sea disposal licence applications must be supported by a detailed assessment of the alternative options. This should include a statement setting out the reasons, including financial, that have led to the conclusion that deposit of the materials at sea is the BPEO.'*

There is no further guidance available in Scotland on BPEO assessment for disposal of dredged material. This BPEO adopts an approach that considers three aspects: strategic, environmental and financial. The strategic and environmental considerations for each option are described in Sections 4.2 and 4.3, and an evaluation of the relative operating costs of each option is provided in Section 4.4. Section 5 then summarises the option assessment and concludes the BPEO.

4.2. Deposition at sea

4.2.1. Strategic considerations

Operational considerations

The operational practicalities of depositing dredged material at a licensed sea deposit site are straightforward: a split hopper barge would discharge material directly at the deposit site. No preparation of the material is required prior to deposition.

Availability of suitable sites

Dredging and deposition at sea has been carried out at Aberdeen North Harbour throughout its history. For the past 80 years at least, dredged material has been deposited at the same offshore site used solely by the Port of Aberdeen (Aberdeen CR110).

Legislative implications

The Port of Aberdeen has powers to dredge under the Aberdeen Harbour Revision Order 2016, provided that the activity is approved by the Scottish Ministers. A marine licence is required from MD-LOT to deposit material at sea.

Section 34 of the Environmental Protection Act 1990 (as amended) makes it a duty to take all measures available as are reasonable in the circumstances to apply the waste hierarchy set out in Article 4(1) of the Waste Directive. The waste hierarchy ranks waste management options according to the best environmental outcome taking into consideration the lifecycle of the material. In its simplest form, the waste hierarchy gives top priority to preventing waste.

When waste is created, it gives priority to reuse, then recycling, then other recovery, and last of all disposal. The option to deposit the dredged material at sea ranks poorly on the waste hierarchy as it is classed as disposal.

4.2.2. Environmental considerations

Safety implications

Deposition at sea has negligible implications for safety providing that standard navigation and maritime safety procedures are observed.

Public health implications

There are no threats to public health associated with deposition of uncontaminated dredged material at sea.

Local Acceptability

There are no anticipated local acceptability issues with continuing the long-standing method of depositing dredged material at sea. The Port of Aberdeen has never received a complaint or enquiry from a member of the public regarding deposition at sea of maintenance dredged material from the North Harbour, and is not aware of any objections received by MD-LOT from members of the public relating to previous marine licence applications.

Pollution/contamination implications

As described in Section 2.2.2, the material to be dredged is considered suitable for deposition at sea according to the Marine Scotland Revised Action Levels, so the risk of pollution/contamination of the marine environment is very low.

Interference with other legitimate interests

The Aberdeen sea deposit site is located in open water outwith shipping channels. There is the potential for interference between the dredging vessel and other users of the sea (e.g. fishing or recreational vessels), which can be managed through compliance with harbour byelaws and standard communications between the dredging crew, Port of Aberdeen and other users. The risk of interference with other legitimate interests is low.

Amenity/aesthetic implications

There are no amenity or aesthetic implications of depositing material at a designated offshore site.

Ecological Implications

Deposition at sea can smother marine life on the seabed within and around the site. As the Aberdeen site has been in use for many years and is subject to annual deposition of material from the North Harbour, it is likely that any benthic species in and around the site can tolerate the periodic disturbance caused by deposition and temporary increases in turbidity.

A dedicated Marine Mammal Observer (MMO) watch will be kept by a nominated crew member aboard the dredger, following the general guidance for and acting in the role of a MMO, to ensure that marine mammals are not in the vicinity when deposition takes place.

4.3. Beach recharge

4.3.1. Strategic considerations

Operational considerations

Beach recharge (sometimes called beach nourishment) requires clean, sandy material. The dredged material is predominantly mixed silt and sand (see Section 2.2.1) so is unlikely to be suitable.

Beach recharge/nourishment would require either a pipeline connected to the dredger to pump material ashore onto the beach, or a dredger capable of accessing the nearshore area to discharge material directly using a 'rainbowing' technique.

For the pipeline method, the loaded dredger would moor at a suitable point offshore and a floating pipeline would pump material onto the beach, where it would then be reprofiled using land-based mechanical plant. For the rainbowing method, the dredging vessel must have sufficiently shallow draft to access the shallow nearshore area. Once ashore, the material would typically be stockpiled in a bund, then recovered and spread during low water.

Both the pipeline and rainbowing methods take significantly longer to discharge than the open water bottom-dumping method used in sea disposal.

Availability of suitable sites

Aberdeen City Council (ACC) and Aberdeenshire Council have confirmed by telephone (October 2025) that they are unlikely to have a use for dredged material within the duration of the proposed marine licence.

The Port of Aberdeen will continue to liaise with ACC and Aberdeenshire Council, and if a project materialises that could make use of the dredged material, it will be considered in a future revision of the BPEO.

Legislative implications

Standing advice from SEPA states that waste material, which includes dredged material, deposited above the low water mark is subject to Waste Management Licensing controls regulated by SEPA unless it is subject to a licence issued under Part 4 of the Marine (Scotland) Act 2010, in which case it is excluded from such controls (SEPA, 2025), provided that it does not constitute a landfill. As beach recharge would require a marine licence, it is assumed that a Waste Management Licence would not be required.

The option to reuse the dredged material for beach recharge ranks favourably on the waste hierarchy; it negates the need to otherwise dispose of the material.

Dredged material to be used for beach recharge requires a licence from the Crown Estate Scotland, and a royalty is payable by the end user for the material.

4.3.2. Environmental considerations

Safety implications

The use of a floating pipeline presents a potential hazard to navigation which would require marking and lighting in accordance with standard industry practices.

Pumping or rainbowing material onto the beach and subsequent reprofiling may present a hazard to beach users. It would be necessary to cordon off areas of the beach during the recharge operation.

Public health implications

As described in Section 2.2.2, the material to be dredged is considered suitable for deposition at sea according to the Marine Directorate Revised Action Levels, so the use of the material on the beach is highly unlikely to present issues for public health.

Pollution/contamination implications

As described in Section 2.2.2, the material to be dredged is considered suitable for deposition at sea according to the Marine Directorate Revised Action Levels, so the risk of pollution/contamination of the beach environment is very low.

Interference with other legitimate interests / Amenity implications

As described above, during a beach recharge operation it would be necessary to restrict access to areas of the beach and the inshore waters around the dredger. This is unlikely to be a significant concern due to the short term nature of the operation.

Ecological Implications

There are no significant ecological issues with using dredged material for beach recharge. It is preferable for the source material to match the existing beach material: the material to be dredged is predominantly mixed silt and sand (see Section 2.2.1).

4.4. Operational cost evaluation

Table 1 and Table 2 present estimates of the relative operating costs of deposition at sea and beach recharge for 100,000 m^3 of dredged material, based on the Port of Aberdeen's experience of the UK dredging industry. Dredging costs can vary considerably year-to-year depending on dredger availability, fuel prices and other factors.

Table 1 Estimated cost of sea deposit of 100,000 m^3

Dredger Mobilisation	£50,000
Dredger Costs @ £2.50/m^3	£250,000
TOTAL	£300,000

Table 2 Estimated cost of dredging 100,000 m^3 of material, of which 30,000 m^3 is assumed suitable for beach recharge[1]

Lag Pipeline	£400,000
Dismantle Pipeline	£100,000
Hire of Plant	£50,000
Pumping Costs @ £1/m^3	£30,000
Dredger Mobilisation	£50,000
Dredge Costs @ £2.50/m^3	£250,000
TOTAL	£880,000

[Excludes royalty payable to The Crown Estate Scotland by the end user for using dredged material as a resource]

5. Best practicable environmental option

Two potential options are considered in the assessment: deposition at sea and beach recharge.

Operationally, both options are technically practicable but deposition at sea is the preferred option as it is a simpler and more efficient operation, maintains the maximum flexibility of dredging equipment, and utilises an existing licensed sea deposit site (Aberdeen CR110). A suitable beach recharge site is a fundamental requirement, and discussions with ACC and Aberdeenshire Council have confirmed that they are unlikely to require material within the timeframe of the proposed marine licence.

Environmentally, beach recharge is the preferred option according to the waste hierarchy as it uses a material that would otherwise be disposed. Neither option is likely to cause significant ecological, safety, public health, amenity or pollution/contamination issues.

Financially, the costs are almost three times greater for beach recharge than for deposition at sea.

Considering all three aspects, depositing dredged material at sea at Aberdeen CR110 is the BPEO.

[1] 30% is a reasonable assumption considering the average sand content is 42%, not all of which could be extracted/separated from silts during the dredging process.

6. References

MD-LOT (2015). Marine Scotland Guidance for Marine Licence Applicants: Version 2 - June 2015. https://www.gov.scot/publications/marine-licensing-applications-and-guidance/ [accessed 2 October 2025].

SEPA (2025) https://www.sepa.org.uk/data-visualisation/waste-sites-and-capacity-tool/ [accessed 2 October 2025].

SEPA (2025) SEPA standing advice for the Department for Business, Energy and Industrial Strategy and Marine Directorate on marine consultations. Version 10, January 2025.

Appendix A
2025 sediment sampling results

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

SOCOTEC

Test Report ID MAR02764

Issue Version: 1

Customer: Port of Aberdeen, 16 Regent Quay, Aberdeen, AB11 5SS

Customer Reference: Marine Scotland Sediment Analysis

Date Sampled: 18-Aug-25

Date Samples Received: 20-Aug-25

Test Report Date: 24-Sep-25

Condition of samples: Ambient Satisfactory

Opinions and Interpretations expressed herein are outside the scope of our UKAS accreditation
The results reported relate only to the sample tested
The results apply to the sample as received

[Redacted]

Authorised by: Jane Colbourne

Position: Customer Service Specialist

UKAS TESTING
1252

Certificate of Analysis

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Test Report ID	MAR02764
Issue Version	1
Customer Reference	Marine Scotland Sediment Analysis

		Units	%	%	%	%	%	Mg/m3	N/A
		Method No	ASC/SOP/303	ASC/SOP/303	SUB_01*	SUB_01*	SUB_01*	SUB_02*	SUB_02*
		Limit of Detection	0.2	0.2	N/A	N/A	N/A	N/A	N/A
		Accreditation	UKAS	UKAS	N	N	N	N	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Total Moisture @ 120°C**	**Total Solids**	**Gravel (>2mm)**	**Sand (63-2000 µm)**	**Silt (<63 µm)**	**Particle Density**	**Asbestos**
N-1	MAR02764.001	Sediment	48.1	51.9	0.00	47.41	52.59	2.62	NAD
N-2	MAR02764.002	Sediment	50.3	49.7	0.00	34.80	65.20	2.59	NAD
N-3	MAR02764.003	Sediment	46.5	53.5	0.00	43.16	56.84	2.61	NAD
N-4	MAR02764.004	Sediment	48.3	51.7	0.00	45.62	54.38	2.57	NAD
N-5	MAR02764.005	Sediment	57.7	42.3	1.26	50.62	48.12	2.53	NAD
N-6	MAR02764.006	Sediment	61.4	38.6	2.02	42.95	55.03	2.50	NAD
N-7	MAR02764.007	Sediment	55.2	44.8	0.00	39.45	60.55	2.52	NAD
N-8	MAR02764.008	Sediment	61.6	38.4	0.00	31.63	68.37	2.52	NAD
N-9	MAR02764.009	Sediment	62.4	37.6	0.86	43.28	55.86	2.57	NAD
N-10	MAR02764.010	Sediment	49.7	50.3	0.00	46.15	53.85	2.55	NAD
S-1	MAR02764.011	Sediment	27.1	72.9	0.07	97.67	2.26	2.65	NAD
S-2	MAR02764.012	Sediment	59.0	41.0	0.88	38.67	60.45	2.65	NAD
S-3	MAR02764.013	Sediment	55.8	44.2	0.75	36.31	62.95	2.61	NAD
S-4	MAR02764.014	Sediment	53.6	46.4	0.86	30.64	68.50	2.55	NAD
S-5	MAR02764.015	Sediment	64.7	35.3	0.00	23.68	76.32	2.62	NAD
S-6	MAR02764.016	Sediment	64.1	35.9	0.00	21.50	78.50	2.61	NAD
S-7	MAR02764.017	Sediment	32.9	67.1	4.41	38.10	57.49	2.65	NAD

* See Report Notes

NAD - No Asbestos Detected

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Test Report ID	MAR02764
Issue Version	1
Customer Reference	Marine Scotland Sediment Analysis

		Units	mg/Kg (Dry Weight)							
		Method No	ICPMSS*							
		Limit of Detection	0.5	0.04	0.5	0.5	0.01	0.5	0.5	2
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Mercury**	**Nickel**	**Lead**	**Zinc**
N-1	MAR02764.001	Sediment	6.7	0.12	23.6	8.9	0.09	14.2	11.9	44.5
N-2	MAR02764.002	Sediment	8.2	0.15	29.0	13.2	0.07	17.5	15.4	55.9
N-3	MAR02764.003	Sediment	6.9	0.16	24.9	11.5	0.04	16.0	12.1	48.1
N-4	MAR02764.004	Sediment	7.8	0.21	29.4	23.2	0.06	18.1	15.2	58.2
N-5	MAR02764.005	Sediment	8.6	0.23	26.2	37.0	0.06	16.6	16.1	66.8
N-6	MAR02764.006	Sediment	10.2	0.26	32.0	61.0	0.07	20.0	18.5	77.5
N-7	MAR02764.007	Sediment	10.0	0.36	36.5	104	0.11	21.7	24.6	105
N-8	MAR02764.008	Sediment	11.8	0.32	39.2	63.4	0.08	24.0	23.2	94.9
N-9	MAR02764.009	Sediment	10.5	0.29	33.4	48.8	0.07	19.6	20.4	75.5
N-10	MAR02764.010	Sediment	7.9	0.20	28.7	26.9	0.05	17.8	15.2	65.4
S-1	MAR02764.011	Sediment	6.1	<0.04	9.4	2.7	<0.01	5.9	4.1	30.3
S-2	MAR02764.012	Sediment	9.1	0.14	27.8	10.0	0.04	17.4	13.2	48.6
S-3	MAR02764.013	Sediment	7.8	0.16	28.2	10.8	0.04	17.9	14.5	48.1
S-4	MAR02764.014	Sediment	11.0	0.19	39.7	24.2	0.06	25.3	22.7	71.4
S-5	MAR02764.015	Sediment	11.2	0.22	41.5	27.2	0.06	26.1	24.0	74.4
S-6	MAR02764.016	Sediment	10.5	0.22	40.4	32.7	0.08	25.6	22.9	77.7
S-7	MAR02764.017	Sediment	7.5	0.15	31.9	22.2	0.05	21.3	16.1	59.0
Certified Reference Material SETOC 768 (% Recovery)			95	103	89	84	93	92	97	99
QC Blank			<0.5	<0.04	<0.5	<0.5	<0.01	<0.5	<0.5	<2

* See Report Notes

Certificate of Analysis

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Test Report ID MAR02764
Issue Version 1
Customer Reference Marine Scotland Sediment Analysis

		Units	µg/Kg (Dry Weight)	
		Method No	ASC/SOP/301	
		Limit of Detection	1	1
		Accreditation	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Dibutyltin (DBT)**	**Tributyltin (TBT)**
N-1	MAR02764.001	Sediment	<5	<5
N-2	MAR02764.002	Sediment	<5	<5
N-3	MAR02764.003	Sediment	<5	<5
N-4	MAR02764.004	Sediment	<5	<5
N-5	MAR02764.005	Sediment	<5	<5
N-6	MAR02764.006	Sediment	<5	<5
N-7	MAR02764.007	Sediment	<5	<5
N-8	MAR02764.008	Sediment	<5	<5
N-9	MAR02764.009	Sediment	<5	<5
Certified Reference Material BCR-646 (% Recovery)			112	98
QC Blank			<1	<1

* See Report Notes

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Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID	MAR02764
Issue Version	1
Customer Reference	Marine Scotland Sediment Analysis

		Units	µg/Kg (Dry Weight)	
		Method No	ASC/SOP/301	
		Limit of Detection	1	1
		Accreditation	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Dibutyltin (DBT)**	**Tributyltin (TBT)**
N-10	MAR02764.010	Sediment	<5	<5
S-1	MAR02764.011	Sediment	<5	<5
S-2	MAR02764.012	Sediment	<5	<5
S-3	MAR02764.013	Sediment	<5	<5
S-4	MAR02764.014	Sediment	<5	<5
S-5	MAR02764.015	Sediment	<5	<5
S-6	MAR02764.016	Sediment	<5	<5
S-7	MAR02764.017	Sediment	<5	<5
Certified Reference Material BCR-646 (% Recovery)			72	67
QC Blank			<1	<1

* See Report Notes

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID MAR02764
Issue Version 1
Customer Reference Marine Scotland Sediment Analysis

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**ACENAPTH**	**ACENAPHY**	**ANTHRACN**	**BAA**	**BAP**	**BBF**
N-1	MAR02764.001	Sediment	<5	<5	<5	22.8	33.9	30.6
N-2	MAR02764.002	Sediment	<5	<5	18.0	51.1	71.0	59.9
N-3	MAR02764.003	Sediment	<5	13.7	27.4	92.4	136	89.0
N-4	MAR02764.004	Sediment	<5	10.3	19.9	59.2	86.4	79.5
N-5	MAR02764.005	Sediment	12.8	<5	25.2	62.2	89.6	81.9
N-6	MAR02764.006	Sediment	16.5	16.9	38.1	92.1	137	123
N-7	MAR02764.007	Sediment	17.4	19.2	34.3	104	169	151
N-8	MAR02764.008	Sediment	<1	<1	<1	5.01	7.70	7.30
N-9	MAR02764.009	Sediment	<5	<5	20.7	67.2	99.7	105
N-10	MAR02764.010	Sediment	19.0	19.3	49.3	164	235	160
S-1	MAR02764.011	Sediment	<5	8.59	12.7	38.6	67.5	45.5
S-2	MAR02764.012	Sediment	<5	<5	18.5	53.5	76.6	69.3
S-3	MAR02764.013	Sediment	<5	<5	<5	50.8	94.3	98.8
S-4	MAR02764.014	Sediment	<5	<5	22.2	57.7	85.8	98.0
S-5	MAR02764.015	Sediment	<5	<5	26.0	62.5	90.2	105
S-6	MAR02764.016	Sediment	<5	<5	18.7	50.1	75.7	85.3
S-7	MAR02764.017	Sediment	18.2	8.95	36.0	61.7	123	86.1
Certified Reference Material Quasimeme SED42 (% Recovery)			40	112	89	89	101	95
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries
~ Indicates result is for an In-house Reference Material as no Certified Reference Materials are avaliable.
As the method uses surrogate standards to correct for losses, the RM results are reported as percentage trueness, not recovery.
*See report notes

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Advanced Chemistry and Research, Etwall House, Bretby Business Park, Ashby Road, Burton-upon-Trent DE15 0YZ

Test Report ID MAR02764
Issue Version 1
Customer Reference Marine Scotland Sediment Analysis

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**BENZGHIP**	**BKF***	**CHRYSENE ***	**DBENZAH**	**FLUORANT**	**FLUORENE**
N-1	MAR02764.001	Sediment	35.7	28.7	29.2	<5	45.0	<5
N-2	MAR02764.002	Sediment	58.4	62.4	61.4	10.2	102	10.1
N-3	MAR02764.003	Sediment	101	114	98.2	17.4	185	12.0
N-4	MAR02764.004	Sediment	82.8	78.9	68.7	16.1	110	10.6
N-5	MAR02764.005	Sediment	84.3	78.2	72.2	14.0	125	14.9
N-6	MAR02764.006	Sediment	118	107	106	22.2	182	23.9
N-7	MAR02764.007	Sediment	167	140	131	30.9	198	22.1
N-8	MAR02764.008	Sediment	6.55	6.83	6.24	<1	10.9	<1
N-9	MAR02764.009	Sediment	106	100	79.3	20.0	115	15.6
N-10	MAR02764.010	Sediment	170	159	211	31.4	252	22.3
S-1	MAR02764.011	Sediment	53.6	44.3	43.0	9.92	70.3	<5
S-2	MAR02764.012	Sediment	63.3	66.7	67.6	<5	84.7	<5
S-3	MAR02764.013	Sediment	101	86.2	58.4	17.7	87.1	<5
S-4	MAR02764.014	Sediment	98.4	80.2	62.8	17.6	114	12.7
S-5	MAR02764.015	Sediment	112	89.5	72.1	18.7	125	<5
S-6	MAR02764.016	Sediment	88.8	77.4	58.2	15.9	93.5	<5
S-7	MAR02764.017	Sediment	86.6	75.8	65.7	16.0	120	16.5
Certified Reference Material Quasimeme SED42 (% Recovery)			114	92	105	110	94	65
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries
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Test Report ID MAR02764
Issue Version 1
Customer Reference Marine Scotland Sediment Analysis

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/304	ASC/SOP/303/306
		Limit of Detection	1	1	1	1	100
		Accreditation	UKAS	UKAS	UKAS	UKAS	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**INDPYR**	**NAPTH**	**PHENANT**	**PYRENE**	**THC**
N-1	MAR02764.001	Sediment	33.7	10.7	27.9	45.7	58700
N-2	MAR02764.002	Sediment	54.4	13.9	67.3	110	92700
N-3	MAR02764.003	Sediment	99.1	18.3	81.0	187	90000
N-4	MAR02764.004	Sediment	82.3	21.4	51.8	110	152000
N-5	MAR02764.005	Sediment	73.9	19.8	86.7	136	159000
N-6	MAR02764.006	Sediment	121	32.2	122	182	266000
N-7	MAR02764.007	Sediment	158	30.0	95.9	209	416000
N-8	MAR02764.008	Sediment	7.4	<1	6.08	11.4	21600
N-9	MAR02764.009	Sediment	113	19.9	68.7	120	248000
N-10	MAR02764.010	Sediment	162	26.7	178	330	192000
S-1	MAR02764.011	Sediment	51.3	<5	32.8	81.6	83700
S-2	MAR02764.012	Sediment	67.9	17.8	61.6	104	123000
S-3	MAR02764.013	Sediment	108	16.0	33.8	92.8	109000
S-4	MAR02764.014	Sediment	104	13.5	74.8	114	118000
S-5	MAR02764.015	Sediment	109	17.4	81.2	127	210000
S-6	MAR02764.016	Sediment	93.7	14.5	45.3	88.2	196000
S-7	MAR02764.017	Sediment	78.5	8.38	93.7	126	72100
Certified Reference Material Quasimeme SED42 (% Recovery)			108	87	81	94	85~
QC Blank			<1	<1	<1	<1	<100

For full analyte name see method summaries
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*See report notes

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Test Report ID	MAR02764
Issue Version	1
Customer Reference	Marine Scotland Sediment Analysis

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.08	0.08	0.08	0.08	0.08	0.08	0.08
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB28**	**PCB52**	**PCB101**	**PCB118**	**PCB138**	**PCB153**	**PCB180**
N-1	MAR02764.001	Sediment	0.13	0.09	<0.08	0.08	0.13	0.08	<0.08
N-2	MAR02764.002	Sediment	0.20	0.15	0.15	0.15	0.15	0.12	<0.08
N-3	MAR02764.003	Sediment	0.18	0.11	0.11	0.11	0.11	0.14	0.12
N-4	MAR02764.004	Sediment	0.23	0.16	0.22	0.23	0.28	0.40	0.09
N-5	MAR02764.005	Sediment	0.25	0.19	0.17	0.17	0.16	0.26	<0.08
N-6	MAR02764.006	Sediment	0.25	0.18	0.19	0.16	0.25	0.25	<0.08
N-7	MAR02764.007	Sediment	0.26	0.20	0.23	0.17	0.36	0.43	0.16
Certified Reference Material Quasimeme SED28 (% Recovery)			67	99	100	128	95	102	114
QC Blank			<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08

For full analyte name see method summaries

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Test Report ID MAR02764
Issue Version 1
Customer Reference Marine Scotland Sediment Analysis

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.08	0.08	0.08	0.08	0.08	0.08	0.08
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB28**	**PCB52**	**PCB101**	**PCB118**	**PCB138**	**PCB153**	**PCB180**
N-8	MAR02764.008	Sediment	0.28	0.23	0.22	0.30	0.42	0.31	0.10
N-9	MAR02764.009	Sediment	0.27	0.14	0.26	0.29	0.33	0.40	0.10
N-10	MAR02764.010	Sediment	0.27	0.17	0.18	0.24	0.21	0.20	0.09
S-1	MAR02764.011	Sediment	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
S-2	MAR02764.012	Sediment	0.17	0.08	0.13	0.11	0.26	0.16	<0.08
S-3	MAR02764.013	Sediment	0.15	0.10	0.14	0.18	0.20	<0.08	0.10
S-4	MAR02764.014	Sediment	0.19	0.14	0.17	0.26	0.25	0.25	0.09
S-5	MAR02764.015	Sediment	0.24	0.18	0.20	0.32	0.21	0.29	<0.08
S-6	MAR02764.016	Sediment	0.36	0.24	0.25	0.35	0.31	0.41	0.13
S-7	MAR02764.017	Sediment	0.09	<0.08	0.12	0.12	0.15	0.19	<0.08
Certified Reference Material Quasimeme SED28 (% Recovery)			72	107	104	107	92	91	84
QC Blank			<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08

For full analyte name see method summaries
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REPORT NOTES

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
WSLM59*	MAR02764.001-017	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
ICPMSS*	MAR02764.001-017	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
SUB_01*	MAR02764.001-017	Analysis was conducted by an approved subcontracted laboratory.
SUB_02*	MAR02764.001-017	Analysis was conducted by an approved subcontracted laboratory.
ASC/SOP/301	MAR02764.001-017	The matrix of this sample has been found to interfere with the result for this test. The sample has therefore been diluted, but in doing so, the detection limit for this test has been elevated.
ASC/SOP/303/304	MAR02764.001-007, .009-017	The matrix of this sample has been found to interfere with the result for this test. The sample has therefore been diluted, but in doing so, the detection limit for this test has been elevated.
ASC/SOP/303/304	MAR02764.001-017	Benzo[k]fluoranthene is known to coelute with Benzo[j]fluoranthene and these peaks can not be resolved. It is believed Benzo[j]fluoranthene is present in these samples therefore it is suggested that the Benzo[k]fluoranthene results should be taken as a Benzo[k]fluoranthene (inc. Benzo[j]fluoranthene). Benzo[j]fluoranthene is not UKAS accredited. This should be taken into consideration when utilising the data.
ASC/SOP/303/304	MAR02764.001-017	Chrysene is known to coelute with Triphenylene and these peaks can not be resolved. Triphenylene may be present in these samples therefore it is suggested that the Chrysene results should be taken as a Chrysene (inc. Triphenylene).This should be taken into consideration when utilising the data.

DEVIATING SAMPLE STATEMENT

Deviation Code	Deviation Definition	Sample ID	Deviation Details. The following information should be taken into consideration when using the data contained within this report
D1	Holding Time Exceeded	N/A	N/A
D2	Sample Contaminated through Damaged Packaging	N/A	N/A
D3	Sample Contaminated through Sampling	N/A	N/A
D4	Inappropriate Container/Packaging	N/A	N/A
D5	Damaged in Transit	N/A	N/A
D6	Insufficient Quantity of Sample	N/A	N/A
D7	Inappropriate Headspace	N/A	N/A
D8	Retained at Incorrect Temperature	N/A	N/A
D9	Lack of Date & Time of Sampling	N/A	N/A
D10	Insufficient Sample Details	N/A	N/A
D11	Sample integrity compromised or not suitable for analysis	N/A	N/A

Certificate of Analysis

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Test Report ID	MAR02764
Issue Version	1
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Method	Sample and Fraction Size	Method Summary
Total Solids	Wet Sediment	Calculation (100%-Moisture Content).Moisture content determined by drying a portion of the sample at 120°C to constant weight.
Particle Size Analysis	Wet Sediment	Wet and dry sieving followed by laser diffraction analysis.
Total Organic Carbon (TOC)	Air dried and ground	Carbonate removal and sulphurous acid/combustion at 1600°C/NDIR.
Metals	Air dried and seived to <63µm	Aqua-regia extraction followed by ICP analysis.
Organotins	Wet Sediment	Solvent extraction and derivatisation followed by GC-MS analysis.
Polyaromatic Hydrocarbons (PAH)	Wet Sediment	Solvent extraction and clean up followed by GC-MS analysis.
Total Hydrocarbon Content (THC)	Wet Sediment	Solvent extraction and clean up followed by GC-FID analysis.
Polychlorinated Biphenyls (PCBs)	Air dried and seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS analysis.

Analyte Definitions

Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name
ACENAPTH	Acenaphthene	C2N	C2-naphthalenes	THC	Total Hydrocarbon Content
ACENAPHY	Acenaphthylene	C3N	C3-naphthalenes	AHCH	alpha-Hexachlorcyclohexane
ANTHRACN	Anthracene	CHRYSENE	Chrysene	BHCH	beta-Hexachlorcyclohexane
BAA	Benzo[a]anthracene	DBENZAH	Dibenzo[ah]anthracene	GHCH	gamma-Hexachlorcyclohexane
BAP	Benzo[a]pyrene	FLUORANT	Fluoranthene	DIELDRIN	Dieldrin
BBF	Benzo[b]fluoranthene	FLUORENE	Fluorene	HCB	Hexachlorobenzene
BEP	Benzo[e]pyrene	INDPYR	Indeno[1,2,3-cd]pyrene	DDD	p,p'-Dichlorodiphenyldichloroethane
BENZGHIP	Benzo[ghi]perylene	NAPTH	Naphthalene	DDE	p,p'-Dichlorodiphenyldichloroethylene
BKF	Benzo[k]fluoranthene	PERYLENE	Perylene	DDT	p,p'-Dichlorodiphenyltrichloroethane
C1N	C1-naphthalenes	PHENANT	Phenanthrene		
C1PHEN	C1-phenanthrene	PYRENE	Pyrene		